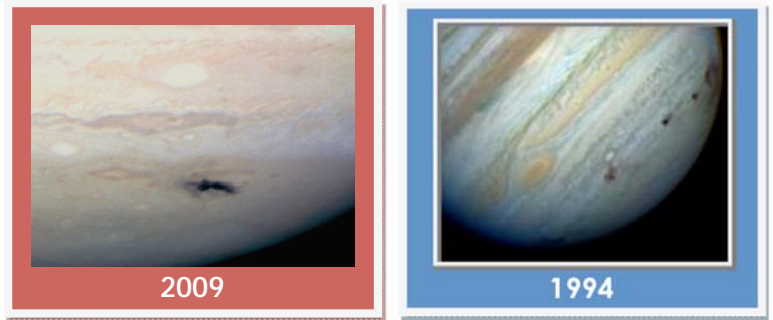


# Conduct Your Own Impactor Size/Scar Investigations



As shared in the “Impact 2009” news article, scientists were able to estimate the size of the unseen object that hit Jupiter by comparing the size of the scar made from the 2009 impact to scars made from the 1994 Shoemaker–Levy 9 Comet impacts.

In 1994, scientists were able to observe the size of each of the 21 comet fragments before they struck Jupiter and the resulting size of the scars left behind.

Using this information, scientists were able to infer the size of the unseen object that hit Jupiter in 2009 to be a few 100 meters in diameter, somewhere between the largest(1km) and smallest(tens of meters) of the comet impactors that hit Jupiter in 1994.

Overview: In this activity, participants are invited to explore how an impactor’s size affects impact scars.

## Materials: (per team)

- (4) various size rocks
- cm measuring tape
- meter stick
- water
- corn syrup, dish soap, or other thick liquid (optional)
- aluminum pie pan marked at the 3/4 level
- “Impactor” Data Collection Sheet
- outside sidewalk area

Procedure: This investigation should be conducted outside on a flat sidewalk area.

1. Fill an aluminum pie pan with water.
2. Measure the diameter (distance across the center) of each impactor and record this information in the "Impactor Data Collection Table".
3. Make a prediction about which impactor will leave the largest and smallest impact scars.
4. Using a meter stick, select a drop height measurement from which all of the impactors will be dropped.
5. Drop Impactor # 1 from the specified drop height and quickly measure and record the diameter of the splash zone on the ground in the "Impactor Data Collection Table".
6. Move the aluminum pan to a new location out of the previous splash zone, filling 3/4 full with water and repeat procedure #5 with Impactors 2-4.
7. Analyze "Impact Data Collection Table" observations to conclude which impactor made the largest and smallest scars. Compare predictions with investigation findings. What can be said about an impactor's size and the impact scar created?
8. Participants could explore changing the dropping height and repeat the investigation to see how height (and velocity) affects the splash zone.

### Lesson Extension: “Unseen Mystery Impactor”

Without participants viewing, create a splash scar from the specified drop height using one of the 4 impactors. Have a small bucket of water ready to wet the other 3 rocks not used to create the scar experiment.

Present the scar to participants whose job it is to figure out which impactor 1-4 made the splash scar through analysis of the scar made and information from their previous impactor experiment.

### A Greater Challenge – What is the estimated size of an unseen Impactor #5?

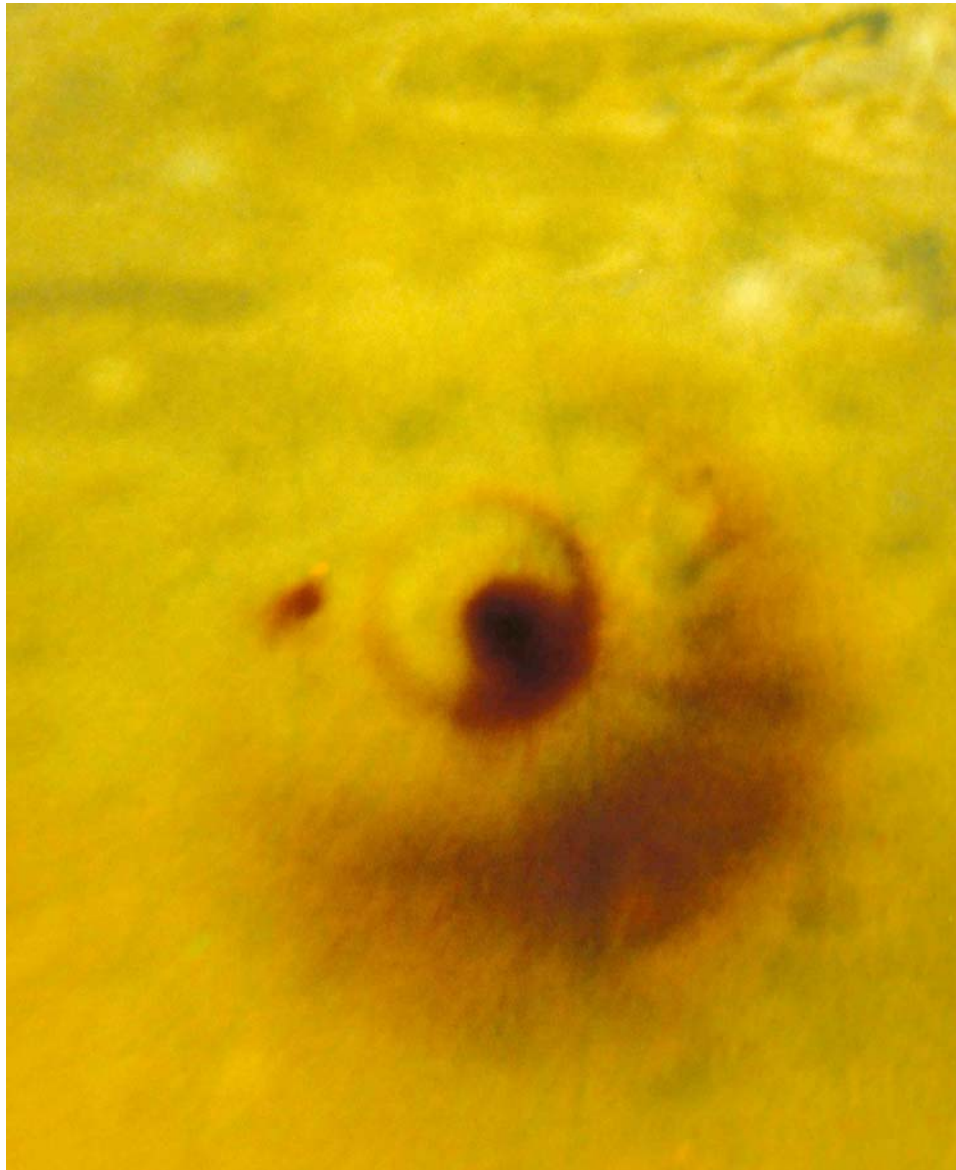
An even greater challenge would be to use a mystery object to create the mystery impact scar that has a diameter somewhere between the other four impactors. The goal would be for participants to estimate the approximate size of the unseen impactor by comparing the size of the scar made to scars made by known impactors.

### Extended Knowledge – How does liquid density affect the impact scar?

Have participants guess the affect of using a thicker liquid, such as corn syrup, dish soap, etc. Is the splash zone larger or smaller? If we know the size of an impactor and its velocity (equivalent to height in this experiment), what can be learned about the target’s density by studying the impact scar size?

### Did You Know?

Much like dropping a rock in a pan of water, not only was a splash zone created, but waves were generated by the impacts on Jupiter. They could be seen as outward moving circular patterns in the impact debris following the impacts of the larger fragments in 1994.



Name: \_\_\_\_\_

Date: \_\_\_\_\_

### Impactor Data Collection Table

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Impactor #	Diameter of Impactor	Diameter of Splash Impact Scar
1	cm	
2	cm	
3	cm	
4	cm	

**Q.** Now that you have measured the diameter of the impactors, which impactor do you think will make the largest and smallest splash impact scars?

**Prediction:** I think \_\_\_\_\_

\_\_\_\_\_

because \_\_\_\_\_

\_\_\_\_\_

**Conclusion:** I found out that \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

## Mystery Scar Investigation

**Hypothesis:** I think impactor number \_\_\_\_\_ made the mystery scar because \_\_\_\_\_

\_\_\_\_\_

**Conclusion:** The mystery impactor was number \_\_\_\_\_.

## Impactor Size Challenge

**Q.** What was the approximate size of the unseen 5<sup>th</sup> impactor that made the last splash impact scar?

**Hypothesis:** I think the approximate size of the last unseen impactor must have been around \_\_\_\_\_.

I think this because \_\_\_\_\_

\_\_\_\_\_

**Conclusion:** I found at that the impactor that made the last splash impact scar was \_\_\_\_\_ in diameter.